

THAT CLAIMED IS:

1. A septum valve having peripheries thereof adapted to be fixedly positioned in a valve housing of a trocar system comprising:

a valve body having an annular-shaped valve opening positioned in a medial portion of the valve body and adapted to individually and separately receive a plurality of different elongate tools each having a different diameter therethrough so that when any one of the plurality of elongate tools is positioned through the valve opening a septum seal is maintained between peripheries of the valve body surrounding the valve opening and abuttingly contacting outer peripheries of the any one of the plurality of elongate tools extending therethrough, the valve body having first and second layers of a fabric material and a layer of elastomeric material positioned between and contacting each of the first and second layers of the fabric material; and

a periphery valve section connected to and extending radially outwardly from peripheries of the valve body and having an outer perimeter thereof adapted to be fixedly connected to the valve housing, the periphery valve section having a plurality of rib members each radially extending substantially an entire distance between an outer perimeter of the valve body and the outer perimeter of the periphery valve section and symmetrically positioned spaced-apart from each other, the periphery valve section having a greater flexibility than the valve body.

2. The septum valve of Claim 1, wherein each of the plurality of elongate tools has a diameter in the range of about 4 millimeters to 13 millimeters, and wherein the annular-shaped valve opening has a diameter less than about 4 millimeters.

3. The septum valve of Claim 1, wherein the periphery valve section further has a plurality of convolutes each positioned between and connected to any two adjacent rib members, the plurality of convolutes each extending toward a proximal end of the valve housing and being in a selected biased position before and after individually and separately receiving a plurality of different elongate tools through the valve opening.

4. The septum valve of Claim 1, wherein the periphery valve section is formed of the same elastomeric material as the elastomeric layer of the valve body.

5. The septum valve of Claim 1, wherein the layer of elastomeric material is intermeshed

with the first and second layers of the fabric material of the valve body, the fabric material including at least one of a family of resilient synthetic polymers containing polyurethane, the elastomeric material including polyisoprene and silicone.

6. A septum valve comprising:

a valve body having a valve opening adapted to individually and separately receive a plurality of different elongate tools each having a different diameter therethrough so that when any one of the plurality of elongate tools is positioned through the valve opening a septum seal is maintained between peripheries of the valve body surrounding the valve opening and abuttingly contacting outer peripheries of the any one of the plurality of elongate tools extending therethrough, the valve body having at least one layer of a fabric material and a layer of elastomeric material; and

a periphery valve section connected to and extending radially outwardly from peripheries of the valve body, the periphery valve section having a plurality of rib members each radially extending substantially an entire distance between an outer perimeter of the valve body and an outer perimeter of the periphery valve section.

7. The septum valve of Claim 6, wherein the valve opening has a substantially annular shape and is positioned in a medial portion of the valve body, and wherein the valve opening has a diameter less than the diameter of each of the plurality of tools.

8. The septum valve of Claim 7, wherein each of the plurality of elongate tools has a diameter in the range of about 4 millimeters to 13 millimeters, and wherein the annular-shaped valve opening has a diameter less than about 4 millimeters.

9. The septum valve of Claim 6, wherein the plurality of rib members are symmetrically positioned spaced-apart from each other.

10. The septum valve of Claim 9, wherein the periphery valve section further has a plurality of convolutes each positioned between and connected to any two adjacent rib members, the plurality of convolutes being in a selected biased position before and after individually and separately receiving a plurality of different elongate tools through the valve opening.

11. The septum valve of Claim 6, wherein the periphery valve section is formed of the same

elastomeric material as the elastomeric layer of the valve body.

12. The septum valve of Claim 6, wherein the layer of elastomeric material is intermeshed with the at least one layer of the fabric material in the valve body, the fabric material including at least one of a family of resilient synthetic polymers containing polyurethane, the elastomeric material including polyisoprene and silicone.

13. The septum valve of Claim 12, wherein the layer of elastomeric material is at least as thick as the at least one layer of the fabric material around the valve opening of the valve body.

14. A cap assembly of a trocar system comprising:

- a valve housing having a substantially annular shape, a first opening at a proximal end, and a second opening at a distal end;

- a first valve positioned adjacent the first opening of the valve housing and fixedly positioned entirely within the valve housing, the first valve having an outer perimeter thereof fixedly connected to the valve housing, the first valve including a valve body having an annular-shaped valve opening positioned in a medial portion of the valve body and adapted to individually and separately receive a plurality of different elongate tools each having a different diameter therethrough so that when any one of the plurality of elongate tools is positioned through the valve opening a septum seal is maintained between peripheries of the valve body surrounding the valve opening and abuttingly contacting outer peripheries of the any one of the plurality of elongate tools extending therethrough, the valve body having first and second layers of a fabric material and a layer of elastomeric material positioned between and contacting each of the first and second layers of the fabric material, and a periphery valve section connected to and extending radially outwardly from peripheries of the valve body and having an outer perimeter thereof defining the outer perimeter of the valve fixedly connected to the valve housing, the periphery valve section having a plurality of rib members each radially extending substantially an entire distance between an outer perimeter of the valve body and the outer perimeter of the periphery valve section and symmetrically positioned spaced-apart from each other, the periphery valve section having a greater flexibility than the valve body; and

- a second valve positioned spaced-apart from the first valve and adjacent the second opening of the valve housing, the second valve having an annular flange portion positioned

within the valve housing, annular-shaped sidewalls connected to the annular flange and extending distally when positioned in the valve housing, and at least a pair of valve flaps connected to and extending inwardly from the sidewalls and flange portion, the flange portion retaining portions of the second valve within the valve housing.

15. The cap assembly of Claim 14, wherein each of the plurality of elongate tools has a diameter in the range of about 4 millimeters to 13 millimeters, and wherein the annular-shaped valve opening has a diameter less than about 4 millimeters.

16. The cap assembly of Claim 14, wherein the periphery valve section of the first valve further has a plurality of convolutes each positioned between and connected to any two adjacent rib members, the plurality of convolutes each extending toward the proximal end of the valve housing and being in a selected biased position before and after individually and separately receiving a plurality of different elongate tools through the valve opening.

17. The cap assembly of Claim 14, wherein the periphery valve section is formed of the same elastomeric material as the elastomeric layer of the valve body.

18. The cap assembly of Claim 14, wherein the layer of elastomeric material is intermeshed with the first and second layers of the fabric material in the valve body, the fabric material including at least one of a family of resilient synthetic polymers containing polyurethane, the elastomeric material including polyisoprene and silicone.

19. A cap assembly of a trocar system comprising:

a valve housing having at least one opening; and

at least one valve positioned adjacent the at least one opening of the valve housing, the at least one valve including a valve body having a valve opening adapted to individually and separately receive a plurality of different elongate tools each having a different diameter therethrough so that when any one of the plurality of elongate tools is positioned through the valve opening a septum seal is maintained between peripheries of the valve body surrounding the valve opening and abuttingly contacting outer peripheries of the any one of the plurality of elongate tools extending therethrough, the valve body having at least one layer of a fabric material and a layer of elastomeric material, and a periphery valve section connected to and

extending radially outwardly from peripheries of the valve body, the periphery valve section having a plurality of rib members each radially extending substantially an entire distance between an outer perimeter of the valve body and an outer perimeter of the periphery valve section.

20. The cap assembly of Claim 19, wherein the valve opening of the at least one valve has a substantially annular shape and is positioned in a medial portion of the valve body, and wherein the valve opening has a diameter less than the diameter of each of the plurality of tools.

21. The cap assembly of Claim 20, wherein each of the plurality of elongate tools has a diameter in the range of about 4 millimeters to 13 millimeters, and wherein the annular-shaped valve opening has a diameter less than about 4 millimeters.

22. The cap assembly of Claim 19, wherein the plurality of rib members of the periphery valve section of the at least one valve are symmetrically positioned spaced-apart from each other.

23. The cap assembly of Claim 19, wherein the periphery valve section of the at least one valve further has a plurality of convolutes each positioned between and connected to any two adjacent rib members, the plurality of convolutes each extending toward the proximal end of the valve housing and being in a selected biased position before and after individually and separately receiving a plurality of different elongate tools through the valve opening.

24. The cap assembly of Claim 19, wherein the periphery valve section is formed of the same elastomeric material as the elastomeric layer of the valve body.

25. The cap assembly of Claim 19, wherein the layer of elastomeric material is intermeshed with the at least one layer of the fabric material in the valve body, the fabric material including at least one of a family of resilient synthetic polymers containing polyurethane, the elastomeric material including polyisoprene and silicone.

26. A trocar system comprising:

a cannula having an elongate cannula body, the cannula body including medial and distal at least portions thereof having a first diameter and a proximal portion thereof connected to the

medial portion and having a second diameter, the second diameter being greater than the first diameter;

a valve housing being readily detachably connected to the proximal portion of the cannula body;

at least one valve positioned in the valve housing and having an outer perimeter thereof fixedly connected to the valve housing, the at least one valve including a valve body having an annular-shaped valve opening positioned in a medial portion of the valve body and adapted to individually and separately receive a plurality of different elongate tools each having a different diameter therethrough so that when any one of the plurality of elongate tools is positioned through the valve opening a septum seal is maintained between peripheries of the valve body surrounding the valve opening and abuttingly contacting outer peripheries of the any one of the plurality of elongate tools extending therethrough, the valve body having first and second layers of a fabric material and a layer of elastomeric material positioned between and contacting each of the first and second layers of the fabric material, and a periphery valve section connected to and extending radially outwardly from peripheries of the valve body and having an outer perimeter thereof defining the outer perimeter of the septum valve fixedly connected to the valve housing, the periphery valve section having a plurality of rib members each radially extending substantially an entire distance between an outer perimeter of the valve body and the outer perimeter of the periphery valve section and symmetrically positioned spaced-apart from each other, the periphery valve section having a greater flexibility than the valve body; and

a plurality of tools each having an elongate body for extending through the valve housing, the valve opening of the at least one valve, and the cannula.

27. The trocar system of Claim 26, wherein the valve housing has a substantially annular shape and first and second openings, the first opening positioned at a proximal end and adjacent the at least one septum valve, the second opening positioned at a distal end and having at least one cannula body mating portion associated therewith and wherein the proximal portion of the cannula body has at least one valve housing mating portion associated therewith so that the cannula body can matingly attach to the valve housing in a secured position.

28. The trocar system of Claim 26, further comprising:
a second valve positioned adjacent the second opening of the valve housing, the second valve having an annular flange portion positioned within the valve housing, annular-shaped sidewalls connected to the annular flange and extending distally when positioned in the valve housing, and at least a pair of valve flaps connected to and extending inwardly from the sidewalls and flange portion, the flange portion retaining at least portions of the second valve within the valve housing.
29. The trocar system of Claim 26, wherein the periphery valve section further has a plurality of convolutes each positioned between and connected to any two adjacent rib members, the plurality of convolutes each extending toward a proximal end of the valve housing and being in a selected biased position before and after individually and separately receiving a plurality of different elongate tools through the valve opening.
30. The trocar system of Claim 26, wherein the periphery valve section is formed of the same elastomeric material as the elastomeric layer of the valve body.
31. The trocar system of Claim 26, wherein the layer of elastomeric material is intermeshed with the first and second layers of the fabric material in the valve body, the fabric material including at least one of a family of resilient synthetic polymers containing polyurethane, the elastomeric material including polyisoprene and silicone.
32. A method of forming a septum valve for a trocar system, comprising the steps of:
providing a slab of an elastomeric material, a first layer of a fabric material overlying the elastomeric material and a second layer of a fabric material underlying the elastomeric material;
cutting a disc shape in the slab;
compressing the slab so that the elastomeric material extends outwardly from peripheries of the first and second layers of the fabric material; and
curing the compressed slab to form a septum valve for a trocar system.
33. A method of constructing a cap assembly for a trocar system, comprising the steps of:
inserting a septum valve into a valve housing, the septum valve including a valve body having an annular-shaped valve opening positioned in a medial portion of the valve body and

adapted to receive individually and separately a plurality of tools therethrough so that when any one of the plurality of elongate tools is positioned through the valve opening a septum seal is maintained between peripheries of the valve body surrounding the valve opening and abuttingly contacting outer peripheries of the any one of the plurality of elongate tools extending therethrough, the valve body having first and second layers of a fabric material and a layer of elastomeric material positioned between and contacting each of the first and second layers of the fabric material, and a periphery valve section connected to and extending radially outwardly from peripheries of the valve body and having an outer perimeter thereof adapted to be fixedly connected to the valve housing, the periphery valve section having a plurality of rib members each radially extending substantially an entire distance between an outer perimeter of the valve body and the outer perimeter of the periphery valve section and symmetrically positioned spaced-apart from each other, the periphery valve section having a greater flexibility than the valve body;

placing a compression ring into the valve housing adjacent the septum valve, the compression ring having an ultraviolet bonding agent associated therewith and abuttingly contacting the outer perimeter of the periphery valve section;

inserting a second valve into the valve housing adjacent and abuttingly contacting the compression ring;

placing a seal ring into the valve housing adjacent the second valve, the seal ring having an ultraviolet bonding agent associated therewith and abuttingly contacting outer peripheries of the second valve; and

curing the assembly with ultraviolet light to construct a cap assembly for a trocar system.

34. A method of using a trocar system, comprising the steps of:

providing a cap assembly in a trocar system, the cap assembly comprising a septum valve including a valve body having an annular-shaped valve opening positioned in a medial portion of the valve body and adapted to receive individually and separately a plurality of tools therethrough so that when any one of the plurality of tools is positioned through the valve opening a septum seal is maintained between peripheries of the valve body surrounding the valve opening and abuttingly contacting outer peripheries of the any one of the plurality of tools extending therethrough, the valve body having first and second layers of a fabric material and a layer of elastomeric material positioned between and contacting each of the first and second

layers of the fabric material, and a periphery valve section connected to and extending radially outwardly from peripheries of the valve body and having an outer perimeter thereof adapted to be fixedly connected to the valve housing, the periphery valve section having a plurality of rib members each radially extending substantially an entire distance between an outer perimeter of the valve body and the outer perimeter of the periphery valve section and symmetrically positioned spaced-apart from each other, the periphery valve section having a greater flexibility than the valve body;

inserting a tool through the septum valve and cap assembly comprising the septum valve thereof, during which the periphery valve section is deformed temporarily so that the valve body extends distally by contact pressure from the tool and so that a distal end of the tool is guided toward the valve opening and then the periphery valve section is retracted to its selected biased position upon the complete insertion of the tool;

extending the tool through a cannula body matingly connected to the cap assembly at a proximal portion thereof;

detaching the cap assembly from the proximal portion of the cannula body; and

removing tissue or other specimen from the cannula body.